Requirement of Harmonization among Automotive Ethernet Standardizations

Japan Automotive Software Platform and Architecture
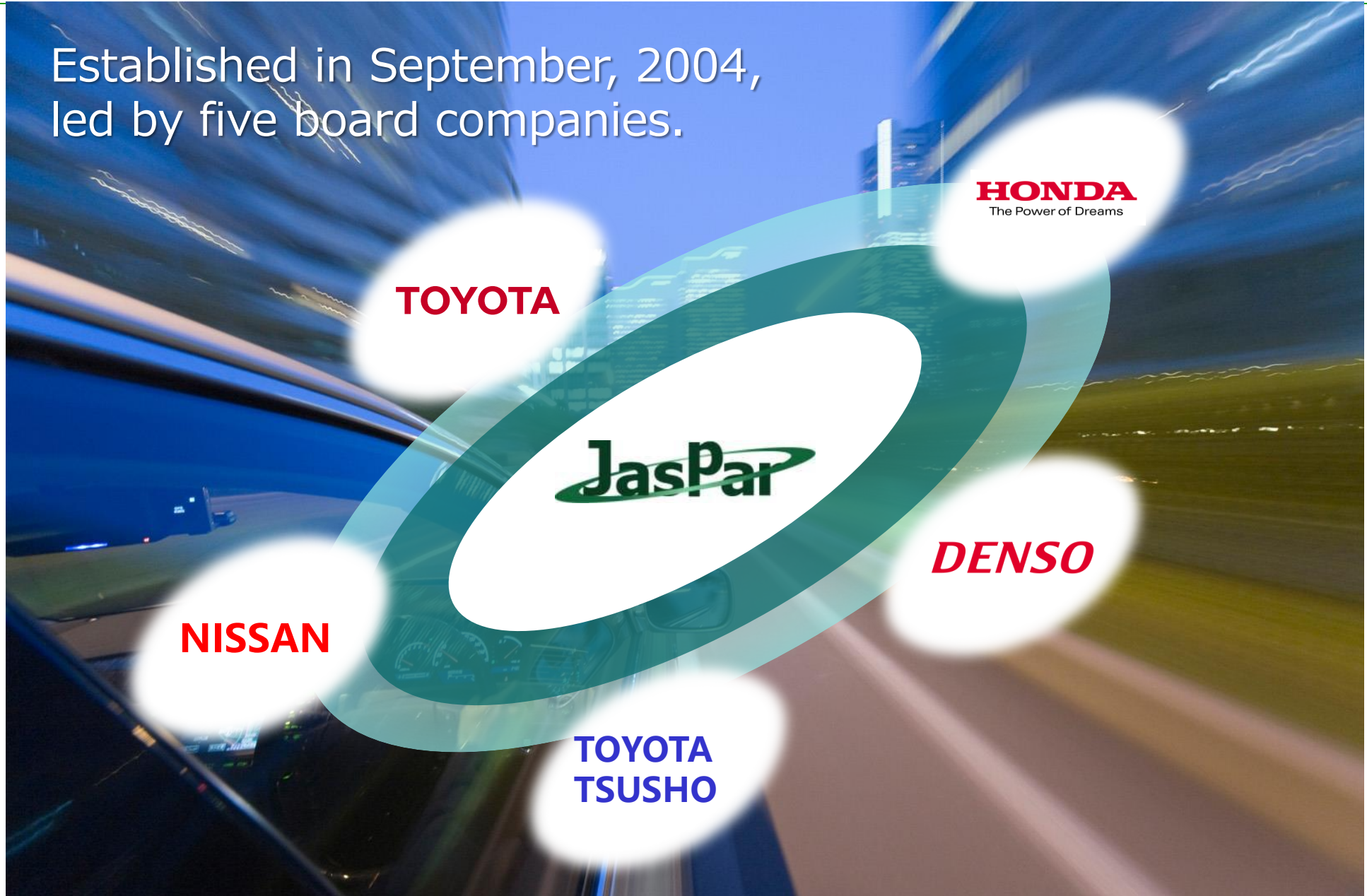
IEEE SA Ethernet & IP @ Automotive Technology Day

JASPAR Next Generation High-Speed Network WG
*Takumi Nomura, Honda
Yoshihiro Ito, Nagoya Institute of Technology
Takeshi Tajima, Aubass
Katsuyuki Akizuki, NEC
Hideki Goto, Toyota

JASPAR, General incorporated association

Established in September, 2004,
led by five board companies.

TOYOTA

HONDA
The Power of Dreams
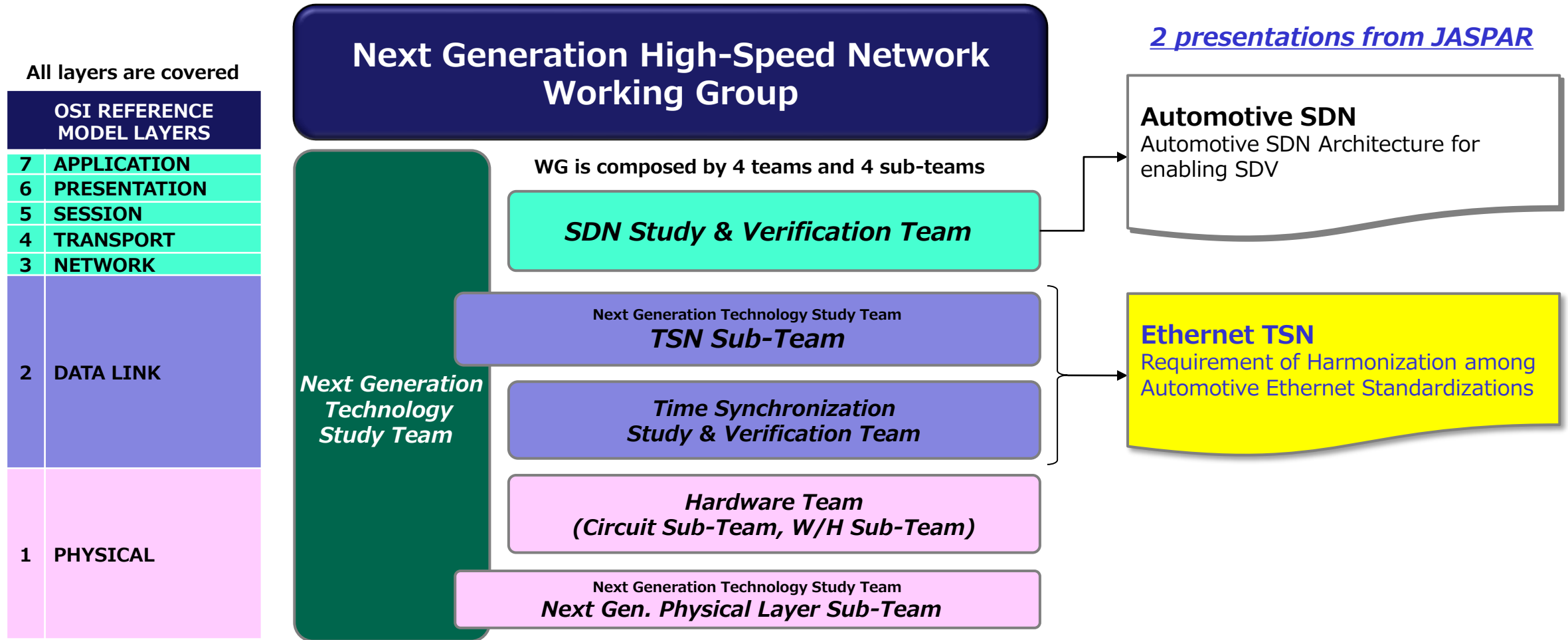
DENSO

NISSAN

TOYOTA
TSUSHO

Next Generation High-Speed Network Working Group

◆ **Activities**

・Definition of functional requirements and use cases for **Automotive SDN**

・Delving into TSN technical survey and defining **Automotive TSN Profiles**, and its verification

・Definition of requirements for Next Generation Automotive Networks which are IEEE standards of **Optical/Electric 10Gb/s and Electric 10Mb/s**

・Definition of Automotive hardware requirements for electric **Multi-Gig Ethernet and MIPI/ASA SerDes**

Working Groups

Functional Safety	AUTOSAR Standardization	Connectivity	Next Generation High-Speed Network	Cyber Security Promotion

Cyber Security Technic

OTA Technic

3
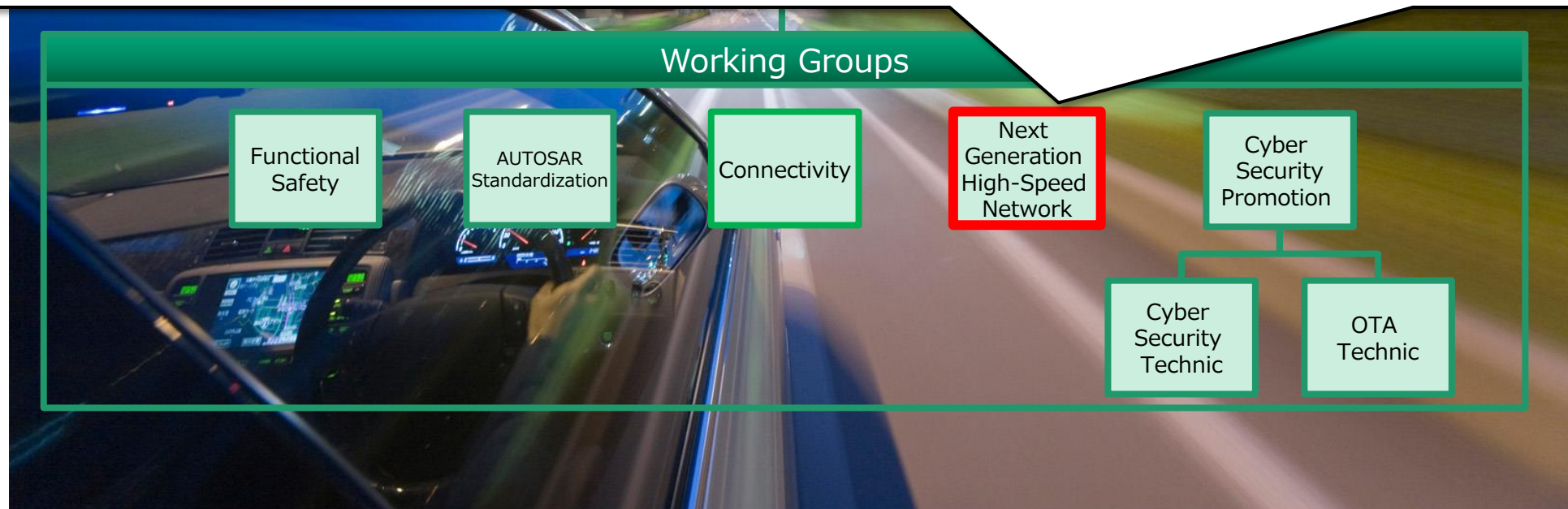
Introduction : 2 Presentations From JASPAR

All layers are covered

	OSI REFERENCE MODEL LAYERS
7	APPLICATION
6	PRESENTATION
5	SESSION
4	TRANSPORT
3	NETWORK
2	DATA LINK
1	PHYSICAL

Next Generation High-Speed Network Working Group

2 presentations from JASPAR

WG is composed by 4 teams and 4 sub-teams

Next Generation Technology Study Team

SDN Study & Verification Team

Automotive SDN
Automotive SDN Architecture for enabling SDV

Next Generation Technology Study Team
TSN Sub-Team

Time Synchronization Study & Verification Team

Ethernet TSN
Requirement of Harmonization among Automotive Ethernet Standardizations

Hardware Team
(Circuit Sub-Team, W/H Sub-Team)

Next Generation Technology Study Team
Next Gen. Physical Layer Sub-Team

Team Composition of Next Gen. High-Speed Network WG

Contents

- **Background**

- **JASPAR's Contribution to IEEE 802.1DG**

- **Solution of the Non-Aligned Standards**

- **Recommend to AUTOSAR**

- **The Ideal of Automotive Profile**

◆ JASPAR showed differences in functions existing profiles for time synchronization.

◆ The problems caused by these differences has also been analyzed.

	Item	P802.1DG (D1.4)	802.1AS (Standard)	AVnu	AUTOSAR
1st analysis	Use of BMCA	Not used	Optional	Yes/Not used	Not used
	Use of Announce message	Yes	Yes	Yes/Not used	Not used
	Use of Signaling message	Undefined	Yes	Yes	Not used
	Use of Pdelay message	Yes	Yes	Yes	Measurement is optional
	Sync message format	2-Step	2-Step (2011) 2-Step/1-Step (2020)	2-Step	2-Step
2nd analysis	Multiple time domains	Yes	No (2011) Yes (2020)	No	Yes (non-Std.)
	Use of VLAN and priority	Undefined	Not used	Not used	Optional
	…	…			…

◆ 1st analysis (BMCA, announce message, signaling message)
　JASPAR has suggested additional modes (like static configuration) for IEEE P802.1DG
　to keep compatibility with existing AUTOSAR/AVnu solutions.

Item	P802.1DG	802.1AS	AVnu	AUTOSAR
Use of BMCA	**Not used**	Optional	Yes/**Not used**	**Not used**
Use of Announce message	Yes	Yes	Yes/Not used	Not used
Use of Signaling message	Undefined	Yes	Yes	Not used

◆ 2nd analysis (Multiple time domains)
　JASPAR pointed out differences in frame formats between IEEE 802.1AS and AUTOSAR.

Item	P802.1DG/ 802.1AS(2020)	AUTOSAR	Case study (Assuming AUTOSAR migraded to AS-2020)
versionPTP	2.1	2.0	2.0 ->2.1 Devices cannot distinguish AUTOSAR profile and IEEE 802.1AS-2020 by "versionPTP."
domainNumber	0..undefined/ 0..255(uint8)	0..15 (uint8)	When "MessageCompliance" is TRUE, multiple domains can be operated based on AS-2020. 0..15 (unit8)->0..255 (unit8)
			When "MessageCompliance" is FALSE, backward compatibility to existing AUTOSAR specifications should be considered. Is it better to keep 0..15 or change to 0..255 ?

◆ From our previous studies, JASPAR was concerned about the **gPTP specification differences between IEEE P802.1DG and AUTOSAR**.

◆ Therefore, JASPAR argued that **coexistence** should be ensured early on the premise so that both IEEE and AUTOSAR will become widespread.

➢ Although our consideration was almost recognized in IEEE P802.1DG, additional contributions were required.

JASPAR Use Case
~Effective Coexistence between AUTOSAR's gPTP and IEEE 802.1DG~

JasPar

2022.7.12

Japan
Automotive
Software
Platform
and
Architecture

Takumi Nomura, Honda
Hideki Goto, Toyota
Katsuyuki Akizuki, NEC
Prof. Yoshihiro Itoh, Nagoya Institute of Technology
Tatsuya Izumi, Sumitomo Electric
Takeshi Tajima, Aubass

Ver.20220112

JASPAR, General incorporated association

JASPAR Use Case ~Effective Coexistence between AUTOSAR's gPTP and IEEE 802.1DG~

Proposal

It is clear that IEEE 802.1DG is the most legitimate specification since it is compliant with IEEE 802.1AS-2011, 2020 (1588).
On the other hand、IEEE 802.1DG adapts an attitude of permissiveness to AUTOSAR as below, and Automotive Industry, which includes JASPAR must express our thanks to IEEE.

AUTOSAR(R) has specified how to do time synchronization over different shared media ([B12], [B13]).
While these solutions do not provide the resolution and accuracy usually expected from [AS] they are widely used and might limit the system wide time synchronization anyway. While not explicitly specified it may be easier to adopt the solutions given in [B12] than work around the more complex intricacies of [AS] described above.

Not only for AS、Coexistence of AUTOSAR and IEEE will be welcome and have **a great effect for Automotive System Engineers**.
It will be also a good for more diffusion of Ethernet TSN.

So that we ask for considering the best course at IEEE.
Ex; Addition the "No Announce Mode" to IEEE 802.1DG profile

Ver.20220112

IEEE 802.1DG, July 2022 Plenary

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◆ In response to a request in Montreal, JASPAR presented additional contributions to IEEE P802.1DG regarding the differences in specifications.
　* The results of the consideration were also introduced at Techday 2022 in Yokohama.
◆ JASPAR asked members of IEEE P802.1DG to analyze in detail and cooperate for the resolution of the differences.
➤ However, JASPAR's position of maintaining neutrality with AUTOSAR needed to be understood correctly by IEEE P802.1DG.

Suggestion from Jaspar

We presented the result of our study regarding the deference among some profiles, including .1DG and AUTOSAR, at Ethernet&IP@Automotive Technology Day last week.

The major differences we extracted are BMCA-related, Multiple Domains, and Use of VLAN.
There may be other ones. However, we can't analyze without exception.
We want t .1DG colleagues to take over this analysis further.

Item	P802.1DG (D1.4)	802.1AS (Standard)	Avnu (v1.6)	AUTOSAR
Use of BMCA	Not used	Optional	Yes/Not used	Not used
Use of Announce message	Yes	Yes	Yes/Not used	Not used
Use of Signaling message	Undefined	Yes	Yes	Not used
Use of Pdelay message	Yes	Yes	Yes	Measurement is optional
Sync message format	2-Step	2-Step/1-Step	2-Step	2-Step
Multiple time domains	Yes	Yes	No	Yes (non-Std.)
Use of VLAN and priority	Undefined	Not used	Not used	Optional
…	…			…

IEEE 802.1DG, Nov. 2022 Plenary　　3

Request to IEEE

.1DG has Liaison relationship with both AUTOSAR and JASPAR.
JASPAR also has Liaisons between AUTOSAR and .1DG, respectively.

Thus, We Will Make Our **BEST Effort** to contribute to aligning the specifications.

Primarily, we want **IEEE** (and AUTOSAR) **to lead** the discussion to create the specification which allows coexistence.
Fundamental specifications regarding Ethernet must be born from IEEE.

IEEE 802.1DG, Nov. 2022 Plenary　　4
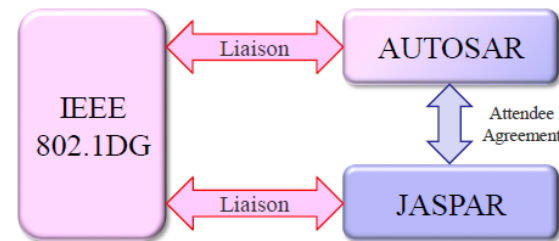
◆ JASPAR presented a revised proposal that **does not use Announce Messages** in principle since JASPAR thought of the need to request to IEEE P802.1DG without any misunderstandings concretely.

◆ AUTOSAR significantly influences the automotive industry and is already in widespread use. Therefore, JASPAR had no choice but to propose revisions to the P802.1DG specification, although it is regrettable to IEEE P802.1DG.

Propositions from Jaspar

Propositions from JASPAR are the following.
Table 15-2: The Value of DGB3 must be changed to "No."
Table 15-3: Announce Message may be defined as "Option" in an additional ITEM DGE*

Table 15-2—Base profile TSN features

ITEM #	TSN FEATURE DESCRIPTION	REFERENCE	VALUE
	Timing and Synchronization (gPTP) (IEEE Std 802.1AS)		Yes
DGB1	Use External Port Configuration?	Annex G.1.1	Yes
DGB2	Use BMCA?	Annex G.1.1	Not used
DGB3	Send Announce messages whether using BMCA or not?	Annex G.1.1	No
DGB4	Send pDelay messages?	Annex G.1.2	Yes
DGB5	Sync message format?	Annex G.1.3	Two-step
DGB6	Minimum number of Domains	Annex G.2	1
DGB7	Maximum number of Domains?	Annex G.2	Undefined
DGB8	Message rates?	Table 22-4, Annex G.1.4	Default values

Table 15-3—Extended profile TSN features

ITEM #	TSN FEATURE DESCRIPTION	REFERENCE	VALUE
	Timing and Synchronization (gPTP) (IEEE Std 802.1AS)		Yes
DGE1	Minimum number of Domains	Annex G.2	2
DGE2	Maximum number of Domains?	Annex G.2	Undefined
DGE3	Configure message rates via Message interval request signaling messages?	Table 22-4, Annex G.1.4	Yes
DGE*	Send Announce Message whether using BMCA or not	Annex G1.1	Option

According to the current automotive use cases, Announce Message is not necessary.
However, considering the new use cases that require Announce Message will appear soon, we propose Announce Message as an Option in the Extended Profile.

Conclusion

Propositions for Amendment:
① Table 15-2: Announce Message changes "No"
② Table 15-3: Announce Message redefine "Option"

The other description regarding Announce Message, except for the above tables, can be revised by JASPAR.

If 802.1DG Task Force does not accept these propositions,
We, Japanese Automotive Industry, will make a judgement on 802.1DG prohibited.

There was a revolutionary change in the work on Draft 2.0 in IEEE P802.1DG.
  ➢ **Time synchronization will be AUTOSAR compliant !?**

IEEE SA STANDARDS ASSOCIATION   ◈**IEEE**

P802.1DG
_____

This PAR is valid until 31-Dec-2023.

PAR Extension Request Date:
PAR Extension Approval Date:
Number of Previous Extensions Requested: 0
_____

1. Number of years that the extension is being requested: 2
2. Why an Extension is Required (include actions to complete): The progress of IEEE P802.1DG has
been delayed by change of Editor. Furthermore, reaching consensus in the automotive industry on the
content of the document takes time. The project had multiple Task Group ballots and the draft is
undergoing a significant revision to reflect a reduced scope. Actions to complete include subsequent Task
Group balloting to reach technical completeness, followed by Working Group balloting and Standards
Association balloting.
3.1. What date did you begin writing the first draft: 28 Mar 2019
3.2. How many people are actively working on the project:20
3.3. How many times a year does the working group meet?
    In person: 6
    Via teleconference: 20
3.4. How many times a year is a draft circulated to the working group: 1
3.5. What percentage of the Draft is stable: 40%
3.6. How many significant work revisions has the Draft been through: 3
4. When will/did initial Standards Association Balloting begin: Mar 2025

When do you expect to submit the proposed standard to RevCom: Dec 2025
Has this document already been adopted by another source? (if so please identify) No
_____

For an extension request, the information on the original PAR below is not open to modification.

Sufficient time is needed to reach a consensus with the Automotive industry association.

1 **0.3 Introductory notes to P802.1DG Draft 2.0**

2 Draft 2.0 was prepared by Max Turner based on the structure of IEEE P802.1DC, and the functionality
3 described in the Autosar Ethernet specifications, as well as the OPEN Alliance TC11 work.

4 The document structure of previous drafts, which was originally suggested by http://www.ieee802.org/1/
5 files/public/docs2019/dg-finn-auto-prof-outline-0119-v02.pdf, as presented on Jan. 15th 2019 during the
6 IEEE 802.1 interim meeting in Hiroshima, Japan was abandoned. The previous Annex Z was deleted. The
7 Bibliography, the Abbreviations, and the Definitions will be repopulated once new text has reached
8 consensus.

9 The Draft creates a completely new modular profile structure. As there were no contributions on the
10 excluded topics from Draft 1.4, these will remain excluded.

11 Further topics have been excluded:

12   —   Life Cycle

13   —   Security

14   —   Safety

15   —   Topology and Redundancy

16   —   Protocols

**• Time synchronization conforms to AUTOSAR.
• Strengthen cooperation with AUTOSAR and OPEN Alliance.**

17 As indicated in https://www.ieee802.org/1/files/public/docs2023/dg-turner-finn-profile-commented-0223-
18 v01.pdf (presented in the call on Feb. 21st 23)

19 In order to avoid duplication, the time synchronization section has been removed and replaced by a
20 reference to the Autosar Time Synchronization specifications.

21 Draft 2.0 will go through Task Group ballot and further development of the document will be based on
22 comment resolution as well as further discussions in Autosar and Open Alliance.

◆ At the IEEE 802 Plenary in July, discussions on AUTOSAR compliance for time synchronization started.

◆ To entirely refer to AUTOSAR, JASPAR confirmed that specifications other than the need for Announce Messages, such as VLAN specifications, also comply with AUTOSAR.

◆ However, some participants still have deep-rooted concerns about AUTOSAR compliance, and **further discussion and consensus building are necessary**.

Originally speaking, AUTOSAR did wrong.

◆ There is no point in saying that AUTOSAR arbitrarily added specifications that IEEE does not have.

◆ JASPAR expressed concerns to AUTOSAR at the Last Open Conference.

◆ JASPAR shared the actual situation of P802.1DG with AUTOSAR.

◆ JASPAR and P802.1DG don't want to have similar but different two time sync protocols from 802.1AS and AUTOSAR.

◆ Referring AUTOSAR_PRS_TimeSyncProtocol by P802.1DG may break above bad double-standard situation.

◆ So now, what should the AUTOSAR PRS TimeSyncProtocol be in the future? and how?

"We need more discussions with more partners."

◆ AUTOSAR R22-11 has a configuration which allows incompatible TLV with 802.1AS–2011. That is "MessageCompliance".

◆ JASPAR concerns that AUTOSAR may update their time sync protocol version up to 2.1 with keeping existing incompatibility.

Semantics of sdoId values

sdoId	QSDO owning the sdoId
0x000	IEEE 1588 Working Group; this value is used for implementations based on IEEE 1588-2008, excluding implementations based on IEEE 802.1AS which uses the value 0x100. It is used for any non-IEEE 802.1AS implementation based on this edition where the expanded profile isolation capabilities are not required.
0x001-0x0FF	IEEE 1588 Working Group; to preserve compatibility with IEEE 1588-2008, these values shall not be used
0x100	IEEE 802.1 Working Group
0x101-0x1FF	IEEE 1588 Working Group; to preserve compatibility with IEEE 1588-2008, these values shall not be used
0x200	IEEE 1588 Working Group; for the Common Mean Link Delay Service
0x201-0x2FF	IEEE 1588 Working Group for future use

◆ JASPAR thinks AUTOSAR may have a unique SdoId when they update their protocol version up 2.1

in accordance with the SdoId policy defined in IEEE 1588-2019

if AUTOSAR wants to keep incompatibility with 802.1 AS in the future.

https://standards.ieee.org/wp-content/uploads/import/documents/tutorials/1588_tutorial.pdf

OEMs／Suppliers

Easy to Refer

**Real Standard
Automotive Profile**

Standardization centered on IEEE

Declaration

- JASPAR will continue to participate and contribute to the standardization of IEEE P802.1DG.

- We will work on AUTOSAR to be consistent with IEEE.

To OEMs and Suppliers

Please participate in the IEEE P802.1DG discussion.

JASPAR alone is too heavy a burden.

Let's formulate the Ideal Automotive Profile together !

Thank you for your kind listening.